TECHNICAL MANUAL FOR USE IN THE DESIGN, INSTALLATION AND MAINTENANCE OF BROOKFIELD MICRO-MODULAR PEAT TREATMENT UNITS

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Brookfield Concrete Products Ltd.
P.O. Box 37, Brookfield, NS B0N 1C0

Phone: 1-902-673-2225 or Toll Free: 1-888-705-2225

Email: info@brookfieldconcrete.ca

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SECTION 1

INTRODUCTION

Brookfield Concrete Products Ltd. located in Brookfield Nova Scotia has been manufacturing septic tanks and other precast concrete products for over thirty years. These products are supplied throughout Nova Scotia, Prince Edward Island, and New Brunswick. Their products include septic tanks ranging in size from 600 to 3500 gallons, holding tanks, pump chambers, flout chambers, oil separators, catch pits, well covers, culvert ends, grade rings, risers, distribution boxes, and more recently, peat treatment units.

Being actively involved with the on-site sewage disposal industry, Brookfield Concrete Products Ltd. became aware of a need for an alternative to the peat treatment units previously available for use in the region. In an effort to make installation of units easier, to provide a more reliable method to split flows between units, and to reduce installation costs, Brookfield Concrete Products constructed several units that were installed at the Nova Scotia On-Site Wastewater Research, Demonstration, and Training Facility located in Bible Hill, Nova Scotia. These units were loaded with septic tank effluent at different rates. Effluent from these units was sampled and tested under a program carried out by the Centre For Water Resources Studies, Dalhousie University. Based on these test results and the preparation of this Technical Manual, approval from Nova Scotia Environment was obtained allowing use of these units in Nova Scotia. As a result, Brookfield Concrete Products Ltd. is now providing their peat treatment units for use in treating domestic sewage. They will supply the septic tank with effluent filter, the distribution box with Flo Equalizers, bottom or pipe discharge peat units, ultra violet light disinfection units where required, and pump chambers where required.

SECTION 2

HOW BROOKFIELD PEAT TREATMENT UNITS WORK

Peat has been used to treat domestic sewage for over 30 years. In Nova Scotia the use of modular peat treatment units has gained popularity in the last several years. These units have mainly been used on difficult sites where the use of conventional on-site sewage disposal systems are not possible or are not economical.

In a system using Brookfield Peat Treatment Units, domestic sewage from the home or commercial establishment first passes through a standard septic tank sized following provincial guidelines. The septic tank is fitted with an effluent filter and riser extended above finished grade to allow cleaning of the filter. Filtered septic tank effluent flows to a distribution box designed and installed to resist settlement and movement due to frost action. Inside the distribution box effluent is split evenly into discharge pipes, each pipe feeding a peat unit. The number of units required will depend on the design flow. Each unit is designed to handle a maximum flow of 250 L/day. Effluent enters the peat unit and discharges into the peat through perforated pipe near the surface of the peat. The specific type of peat has been placed in the units and compacted to the desired density at Brookfield Concrete Product's manufacturing site. The septic tank effluent then trickles downward through the peat. As the effluent passes through the peat it is treated. This treatment is accomplished mainly by filtration and adsorption of particulate matter in the effluent by the peat, plus microbial breakdown of organic material including bacteria that has been retained in the peat. Highly treated peat effluent is then dispersed either to bottom draining units to a dispersal pad/mantle or to a dispersal trench for end draining units to distribute the effluent into the root zone of the native soils.

A Brookfield Peat Treatment System is a passive system requiring no power, has no moving parts, requires little maintenance, uses a natural treatment process, uses local raw materials, and was DESIGNED BY A NOVA SCOTIAN, INITIALLY FOR USE IN NOVA SCOTIA AND IS MANUFACTURED IN NOVA SCOTIA BY NOVA SCOTIAN'S. The Brookfield Peat Treatment System, unlike some other types of peat systems available in the marketplace does NOT require a manufacturer recommended 4" plumbing vent be installed in the home. The Brookfield Peat System may also be installed within 1.5 meters (5') of a driveway or any other traffic area with no damage to the system.

SECTION 3

WHERE IT MAY BE ADVANTAGEOUS TO USE BROOKFIELD PEAT TREATMENT UNITS

Brookfield Peat Treatment units will offer advantages over more conventional on-site sewage disposal systems or other forms of sewage treatment in numerous situations, including:

1. On small lots or on sites with severe restrictions that prevent the use of other types of systems. There are some lots where there is not enough room to install a conventional on-site sewage disposal system. This may be for new construction or for the replacement of existing malfunctioning systems. A Brookfield Micro-Peat Treatment system consisting of components (distribution box and four peat units) will treat up to 1000 liters of sewage effluent per day and will physically fit in an area as small as 3 m x 10 m, excluding the dispersal pad requirements or the end drain treatment trench design.

2. Where the appearance of a system such as a C-2 System, C-3 System or Mound System is objectionable. A Brookfield Peat Treatment system can be designed to blend into finished grade on most sites. Competitive pricing with many other system types is also a factor.

3. In Nova Scotia, the minimum required separation distance from the bottom of the trench in a standard on-site disposal system to water table or bedrock is 1m. This required separation has been reduced to 0.6m from under the bottom of the bottom draining units. The thickness of the permeable dispersion mantle portion under peat cells may be increased by QP1 design to achieve or surpass the required remaining 0.6m of regulatory separation. Imported permeable material must have a permeability of less than the maximum acceptable for filter sand as per NSE Technical Guidelines. Imported material may be in combination with the existing natural permeable soils on the lot to achieve the 1m separation requirement.

4. Where some type of treatment is required and a passive type, using no pumps or moving parts, is desired. As discussed in the Introduction, a Brookfield Peat Treatment system is a passive system with no moving parts. Power is only required where pumping or effluent disinfection is required.

5. Where peat treatment is to be used and other peat products are more expensive, more difficult to obtain, or more difficult to install. The cost of installing Brookfield Peat Treatment should be compared to other products available. Brookfield Concrete Products offer a complete package from the septic tank to the disinfection unit. These products are pre-manufactured and available on short notice. The Brookfield Peat Treatment Units are light enough to be handled by most boom trucks and excavators, making installation easier and less expensive than other similar products on the market

6. Where the owner wishes a higher degree of environmental protection as compared to a conventional septic system. In a conventional system most of the treatment takes place in the natural soil around the disposal field or in the imported sand used to construct the field. In a peat cell treatment system the entire treatment takes place in the contained peat unit before the highly treated effluent is dispersed into the environment.

7. Where treatment is required and the owner does not wish to pay for a mandatory peat maintenance program or sampling and testing of treated effluent. Brookfield Micro Peat Cells themselves do not normally require maintenance or sampling programs and any maintenance can be carried out by the owner in accordance with Section 7 of this manual. Other system components, i.e. Septic tanks, effluent filters and pump /flout chambers will require routine pumping and maintenance as with any on site disposal system.

SECTION 4

OBTAINING APPROVAL TO INSTALL A BROOKFIELD PEAT TREATMENT SYSTEM IN NOVA SCOTIA

Approval to install a Brookfield Peat System will be considered in Nova Scotia where the following conditions are met:

1. The peat system is designed by a QP1 (Professional Engineer) and:

2. Design and installation of the peat system follows the Technical Manual for Use in the Design, Installation, and Maintenance of Brookfield Concrete Products Ltd. Peat Sewage Treatment Units and:

3. The proposed peat system is to replace an existing malfunction system or:

4. The proposed peat system is a new installation that does not discharge to surface.

5. The standard 1000 L per day Brookfield Peat Treatment System contains the following components:

   a) Septic Tank with effluent filter.

   b) Pump chamber (required only if elevation will not allow gravity flow).

   c) Distribution box with adjustable flow equalizers c/w insulation kit OR three

      Flow-splitter T's to divide the flows to the four peat modules.

   d) Four Micro-Peat Modules.

   e) Bottom draining units with dispersal pad/mantle or End draining units with

      Either a dispersal trench or a surface discharge with disinfection.

In Nova Scotia the application and approval procedure for a system using Brookfield Peat Treatment Units is the same as for other on-site sewage disposal systems. An Application for Approval to install the system is submitted to the local office of Nova Scotia Environment. The Application must include the standard supporting documentation including the results of a site assessment, design calculations, and stamped, signed, engineering drawings. Brookfield Concrete Products Ltd. can supply names of qualified consultants who are familiar with their products and will assist with the site assessment, system design, and obtaining the necessary approvals.

SECTION 5
DESIGN OF A BROOKFIELD PEAT TREATMENT SYSTEM

When designing a system using the Brookfield Peat Treatment Units, the following procedure can be followed:

a) Determine the design flow:

The procedure for calculating the design flow is the same as that used for other on-site sewage disposal systems. Appendix F on the Nova Scotia Environment On-Site Sewage Disposal Technical Guidelines (the Guidelines) can be used to establish the best estimate to be used as the design flow. An example of a single family system design is contained in Appendix E.

b) Establish grades:

If the system is to run by gravity the elevation of the peat units will govern the minimum elevation of the distribution box, the septic tank and the elevation of the sewer line at the foundation. The minimum slope on the line from the house to the septic tank will be 2%, from the tank to the distribution box 1% and from the distribution box to the peat filters 1%. The elevation of the top of the peat unit is 75mm to 100 mm above finished grade at the unit, and therefore the elevation of the invert (bottom) of the line entering the unit is 255 mm below finished grade. The elevation of the units may also be governed by the discharge point of a piped discharge, the depth and type of permeable soils under the units and the depth of water table or bedrock under the units. Depending of site conditions and the type of disposal after the units, it may not be possible to lower existing grade to accommodate gravity flow. Where there is inadequate grade to accommodate gravity flow, pumping will be required.

c) Size the pump chamber and discharge per cycle (when pumping is required):

Normally the only time pumping will be required is where the peat units will be at a higher elevation than the distribution box. When required, the pump chamber should be located to receive septic tank effluent and pump the effluent to the distribution box. The recommended dosage per cycles is 100 L per peat unit per cycle. For example, if there were four peat units, the floats in the pump chamber would be set to discharge 400 L per cycle. The pump chamber will require a high level alarm with float set slightly above the “pump on” level. The pump and alarm should be on separate electrical circuits. There should be a minimum of one half the daily design flows available as reserve capacity above the high level alarm setting. For example if the daily design flow was 1000 L, with four peat units the discharge capacity would be 400 L per cycle, there may be 250 L left in the tank at pump off level, 150 L between the “pump on” and “alarm on” levels, 500 L storage above “alarm on” level for a minimum total pump chamber capacity of 1,300 L. When pumping septic tank effluent, either an effluent or sewage pump will be acceptable. The capacity of the pump should consider the total dynamic head of the system. There are numerous references available to assist the designer in proper pump

selection. The pump discharge rate should not exceed 0.5 L/sec/peat unit without prior approval from Brookfield Concrete Products Ltd. In some cases it may be better to pump effluent from the peat unit to the disposal field. In this case the design of the pump and pump chamber would follow the procedure outlined in the Guidelines for pumping septic tank effluent.

d) The distribution box:

A diagram of the distribution box manufactured by Brookfield Concrete Products Ltd. is shown in Appendix A. This box is supplied with the peat units. The standard unit comes with 10 punch out type of holes, sized to receive 100 mm pipe. One hole is for the inlet and nine holes for the outlet lines. The elevations of the inlet and outlet holes relative to the top of the box are shown on the diagram in Appendix A. The number of outlet holes to be used will depend on the number of peat units. Holes not used should be grouted full with hydraulic cement. Each discharge pipe from the box will be fitted with a Flow Equalizer supplied by Brookfield Concrete Products. Special order distribution boxes can be supplied upon request. The number, size, and locations of holes as well as the elevation of the inside bottom can be modified as required. Brookfield Concrete Products supply the distribution box, the cover, insulation cut to fit, and the poly-wrap. Based on the site conditions, the designer is responsible to determine the required elevation of holes as well as bedding requirements.

e) Determine the number of peat treatment units:

The peat units come pre-assembled. For details on the dimensions of the units see Appendix A. The only design requirement is to determine the number of units required based on a daily flow rate of 250 L. per day per unit. The minimum design flow required for residential development in Nova Scotia is 1000 L per day for a home having three or less bedrooms. Therefore there will be a minimum of four units required for a home with three or less bedrooms. For other residential and commercial flows see Appendix F of the Guidelines.

f) Determine Methods Of Peat Treated Effluent Dispersal:

The treated effluent produced through a peat cell is a highly treated and mineral charged effluent. There are numerous types of in ground dispersal systems that can be utilized by a QP1 (Professional Engineer) after the effluent is subjected to peat treatment. The design of these systems must be based on an extensive site assessment including an evaluation of soil conditions. There are possible alternate uses for this peat treated effluent which may be acceptable such as irrigation water on a golf course. An alternate use proposal for dispersal of peat treated effluent on a site may require an additional Approval from a Local or Provincial regulatory authority. For those uses usually a larger volume of effluent is required in excess of what is produced by a single family dwelling. Based on the results of the total site assessment a decision can be made on the best type of dispersal system.

Whenever possible, and where soil conditions allow, the effluent should be dispersed subsurface through a pad/mantle into the native permeable soil below and surrounding the unit(s). The pad/mantle sizing is a standard hydraulic analysis available to a QP1 who will ensure there is adequate subsoil interface to allow for the adsorption and dispersion of the treated effluent into the native soils and the root zone. The surface area of the pad/mantle must be designed based on the type of soil under and surrounding the units. This dispersal pad/mantle may be increased in depth to compensate for site conditions or limited amounts of native permeable soils to ensure regulatory separation requirements. Loading rates for treated effluent from Brookfield Peat Treatment Units are found in Table 1.

This type of pad/mantle shall be a minimum of 100mm above the ports in the side of the units, a minimum of 150mm under the units. The 1/2" to 1" washed stone or sand used in the pad/mantle should have permeability in the acceptable range for the filter sand as specified in the NSE Technical Guidelines (latest edition). All portions of the pad/mantle permeable sands not directly under the peat units must be covered with approved geo-textile mat to ensure integrity of permeability from infiltration from native cover soils.

WE STRONGLY SUGGEST USING 1/2" TO 1" WASHED STONE IN LIEU OF SAND IN THE DISPERSION MANTLE AS SAND QUALITY TENDS TO BE LESS CONSISTENT. THIS MUST CONFORM WITH THE NSE ONSITE SEWAGE DISPOSAL STANDARD.

Table 1

MAXIMUM VERTICAL SOIL LOADING RATES FOR EFFLUENT FROM BROOKFIELD PEAT TREATMENT UNITS	
SOIL TYPE/CLASS	MAXIMUM VERTICAL LOADING RATE ($L/day/m^2$)
Rock, Clean Gravel	0 (Unacceptably High)
Medium to Course Sand	60
Fine Sandy Gravel	40
Silty Sand	32
Sandy Silt	27
Clay Silt	22
Silty Clay	15
Clay - if permeable	8

*A discussion on soil structure is included in Appendix B

1.) The values in the above Table 1 are reflective of there being no clogging mat as the peat

effluent is a treated effluent.

2.) Soil type identification is identified by a Professional Engineer through site assessment criteria in this manual as well as NSE Onsite Sewage Disposal Standard (latest edition).

In any large dispersal system mounding of effluent in the dispersal field can be a concern. Dispersal of treated effluent from the peat unit will flow into subsoils both vertically and horizontally into the native soils and the root zone. This is a particular concern where the dispersal field tends to be square in shape rather than long and narrow. When mounding may be a concern the Professional Engineer should make themselves aware of the theories involved and include considerations for mounding in the calculations of the dispersal system size and shape. The best way to limit or avoid mounding concerns is to keep the dispersal field long and narrow following the contour of the lot topography.

If dispersal under the peat unit is not possible then treated effluent can be directed to a dispersal trench with end drain units. The design is based on the slope of the lot and the horizontal loading rates in Table 2 can be used to calculate the design of the dispersal trench. The required area of the dispersal trench is determined from industry and engineering accepted calculation formulas. Dispersal trench designs should follow the existing lot contours dispersing the treated effluent across the slope.

TABLE 2

GUIDE TO APPROXIMATE HORIZONTAL SOIL PERMEABILITIES

	PERMEABILTY (METERS/SEC) X 10 -6	
SOIL TYPE	APPROXIMATE RANGE	DESIGN VALUE
Medium to Coarse Sand	20 - 800	
Fine Sandy Gravel	20 - 80	20
Silty Sand	8 - 20	15
Sandy Silt	3 - 8	5
Clayey Silt	0.2 - 3	1.5
Silty Clay	0.2 - 0.8	0.5
Clay	<0.8	

If surface discharge is proposed then it must include peat treated effluent disinfection, and this will only be approved in Nova Scotia as a system replacement for an existing malfunction where subsurface dispersal is not possible. If surface discharge is necessary effluent disinfection will be required in Nova Scotia. Brookfield Concrete Products Ltd. will supply an inline type of UV Light Disinfection unit with the other system components. Details of this are contained in Appendix D.

SECTION 6

INSTALLING A BROOKFIELD PEAT TREATMENT SYSTEM

Installation of the Brookfield Concrete Products Peat Treatment System requires no more equipment and is no more complicated than installing a standard on-site sewage disposal system. For details on the dimensions of the peat units see Appendix A. As with any system the first step in installing the system is to carefully review the design drawings and documents plus the approval issued for the installation. These documents should always be reviewed even before giving an estimate for installation. The installer is responsible for installing the system as designed by someone else and the clarity and details of the design provided will vary from one engineer to another. If the installer has any questions or is unclear about any aspect of the installation he should contact the engineer. The engineer is responsible for the system design and represents the client to ensure that the system is installed as designed and following all requirements of the approval. The engineer should be willing to meet the installer on the site prior to installation to be sure the installer is clear on all requirements of the design and approval. The installer should make sure the engineer and the owner are clear on the extent of the work they will be undertaking and what they have included in their estimate and contract. The installer is responsible to make sure the work carried out by him/her will meet the requirements of all regulations and guidelines.

Once the design and approval have been reviewed the next step is to establish the proposed location of the system components and establish grades. Again, if the installer is not clear on the proposed locations or if there is a problem with grades the designer and possibly the owner should be contacted. As with most gravity systems grades are often critical. If there is a discharge point this elevation will govern the lowest elevations of the other components. If effluent distribution is to a dispersal trench or to surface discharge (with approval) the location and elevation will govern the lowest elevations of all other prior components of the system. Working back from the dispersal trench or discharge elevation the minimum slope on the effluent pipe from the peat units to the discharge point or disposal bed should be 1%. The difference in elevation from the base of the peat unit to the invert (bottom) of the influent pipe is 660 mm (26 inches). The minimum slope on the line from the distribution box to the peat unit is 1%. The difference in elevation from the effluent pipe to the inlet pipe on the distribution box is 100 mm (4”). The minimum slope on the line from the distribution box to the peat unit is 1%. The difference in elevation of the effluent and influent pipes in the septic tank is usually 75 or 100 mm depending on the manufacturer. The minimum slope on the sewer line from the tank to the house is 2%. On a gravity system these grades will determine the maximum depth of the sewer pipe at the building. If this grade is above the floor of the foundation or base of the slab a decision will have to be made whether to:

1. work with the designer of the system to see if grades can be lowered
2. set the elevation of the basement floor above this elevation
3. have no plumbing in the basement
4. pump septic tank effluent to the distribution box
5. pump sewage from the building to the septic tank

Once the location and grades of the system components have been established installation can start. It is important to order delivery of the components in advance to prevent construction delays.

The approximate weights of the components supplied by Brookfield Concrete Products Ltd. are:

1. 4500 L* septic tank: two piece: bottom: approximately 2250 kg (5000 lbs)
   top: approximately 2040 kg (4500 lbs)
2. Distribution box: approximately 1225 kg (2700 lbs)
3. Peat Unit (complete with peat): approximately 4265 kg (9400 lbs.)

*** Smaller tanks weigh less and may be utilized as per NSE Technical Guidelines**

It is possible for Brookfield Concrete Products Ltd. to place the components when delivered to the site. However, if equipment is available that has the capacity to safely handle these weighs, the installer can have the units delivered to the site by Brookfield Concrete Products Ltd. and place them later.

To save time and to prevent delays, the arrival of the components should be coordinated with site preparation. Brookfield Concrete Products Ltd. will do whatever possible to accommodate your schedule. However you should always give as much notice as possible.

1. **Septic Tank:**

Installing a septic tank supplied by Brookfield Concrete Products Ltd. follows the same procedure as used when installing septic tanks on other on-site systems. Install the tank carefully following the manufacturer's instructions. Install the tank effluent filter and be sure it can be easily accessed for maintenance

2. **Distribution Box:**

Installation and backfilling of the distribution box is similar to the procedure used for the septic tank. To ensure continued even distribution through the discharge lines it is critical that the box be installed level, does not settle, the contents do not freeze, resists frost heave, and remains level. The design of the base of the box should be done by the designer based on a site assessment. However, the following comments may be of assistance. The height of the standard box is 1.22 m (48 in.) and therefore the base will normally be below frost level. If the base is not below frost level, install a base consisting of a 150 mm layer of compacted crushed rock or 1/2" to 1" stone under the box. If the bottom will be below frost, excavate to the elevation of the base and level as required with sand or stone. Install the box and check to ensure it is level. Adjust if required. Once the box is level insulate the outside of the sides and the inside of the top with 100 mm of rigid insulation. Fasten the insulation to the sides with appropriate adhesive. Wrap the insulation in at least two layers of poly wrap to allow frost slippage. Install the Polylok/ TUF TITE Flow Equalizers and piping. In an effort to get even distribution, provide the same grade (min. 1%) on all discharge pipes leaving the box for at least the first 3 m. Backfill the box carefully following the manufacturer's instructions.

3. **Peat Units:**

Installation and backfilling of the peat units follows a similar procedure used for the septic tank. To ensure continued even distribution through the peat it is critical that the unit be installed level, do not settle, and remain level. The design of the type of unit, pipe discharge or bottom discharge will be done by the designer based on a site assessment. For dimensions of the units and location of inlets and outlets see the diagram in Appendix A. If the units are bottom draining the size and depth of the washed stone mantel will be provided by the designer. Install the unit and check to

ensure it is level. Adjust if required and backfill in accordance with the manufacturer’s instructions.

SECTION 7

MAINTAINING A BROOKFIELD PEAT TREATMENT SYSTEM

Maintaining the Brookfield Concrete Products peat treatment system requires little more than maintaining a standard on-site sewage disposal system. As with any on-site system, the volume and quality of material discharged into the sewer must be controlled to be within the design capacity of the system. Only biodegradable material should be discharged into the system and large peaks in water usage such as doing numerous loads of laundry in the same day should be avoided. Further sources of information on general "do's and don'ts" for on-site sewage disposal systems are available from Nova Scotia Environment or from various web sites.

Some comments on maintenance of the different system components follow (avoid direct contact with sewage, always wear rubber gloves and wash hands and clothes thoroughly after working around a sewer system):

1) **Septic tank and effluent filter:**

If the tank is not pumped often enough, solids will escape the tank and plug the peat units. The required frequency of pumping depends on a number of factors and is difficult to determine prior to the system being operated. The sludge and scum levels should be checked every year, and pumping carried out at least every three years. If the effluent filter is not cleaned, solids will eventually plug it. If the filter becomes plugged, sewage will not leave the tank, will build up in the tank and influent line and may back up into the house or discharge to ground surface. The required frequency for cleaning the filter will vary from system to system. The effluent filter should be cleaned as required and at least every year. Clean the filter by removing it from the tank and washing solids off the filter with a hose. Clean up any solids to avoid accidental contact by people or pets.

2) Pump chamber and pump (if present):

Check the pump chamber every year when checking the septic tank. Make sure the floats are free from debris and are free floating, that the alarm float sets of the alarm when raised above the pump on level, and that there is not an excessive buildup of solids in the chamber. Have the chamber pumped when the septic tank is pumped.

3) **Distribution box and flow Equalizers**:

The distribution box and flow Equalizers should be checked at least yearly. The purpose of these components is to split the flow evenly. Remove any debris that may have accumulated on the Equalizers and adjust them if flow through each is not even. See Appendix C for details on the Equalizers.

4) **Peat units**:

Shallow rooted plants can be grown in the peat units. However weeds or tree seedlings should be removed. No other maintenance of the peat units is required unless for some reason they become plugged with solids or the quality of effluent in a system discharging to surface becomes unacceptable. The most likely cause of this would be improper maintenance of the septic tank or effluent filter which do require routine maintenance. If this occurs it may be necessary to replace all or part of the peat contact Brookfield Concrete Products Ltd.

5) **Disinfection process (if present):**

See manufacturer's instructions in Appendix D regarding required maintenance such as cleaning and replacing the lamp.

It should be noted that peat treatment systems have been utilized within North America for more than 30 plus years especially within continental USA. They continue to function with routine maintenance of the septic tank and proper maintenance as described above. The addition of a septic tank filter to the peat treatment system serves to provide an enhanced constituent particle removal from the septic tank effluent combined with proper maintenance offers the user a prolonged peat treatment system life.